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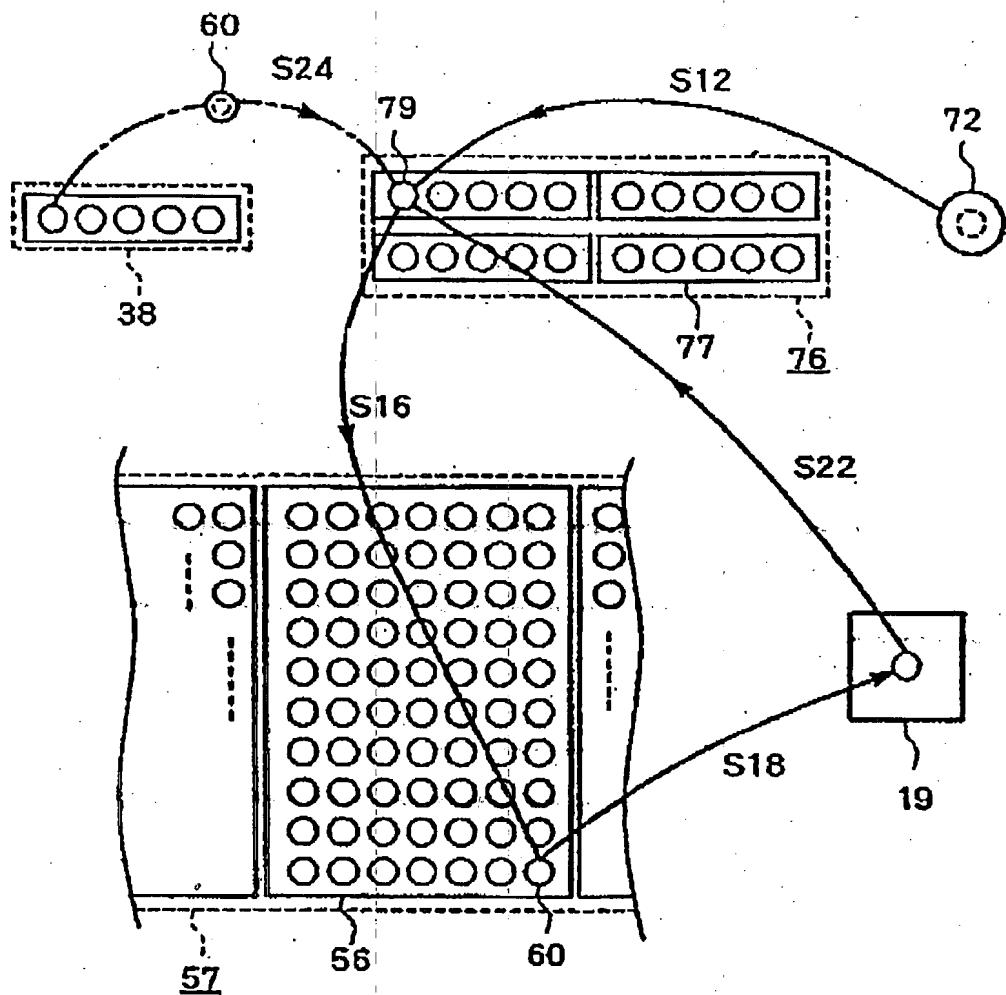
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(54) Assay system for analysis slide, information recorded magnetic card, and assaying apparatus  
therefor.

(57) The assay system (2) for analysis slides (10) uses a magnetic card (4) which is contained in each slide package in order to input information required for determination. The magnetic card (4) carries two types or information which are both required for assay. The two types or information are: fixed information such as the amount of a sample to be spotted, a wave length for photometry, data processing method, coefficients for completing a basic standard curve, a range of values of the amount or activity of an analyte, a display range, the number of digits to be displayed, and display units; and variable information, such as a lot number required for correction of fluctuation of measured or calculated values caused by possible variation of characteristics of analysis films differing from one lot to another, an analyte code, the name of the analyte, and correction or compensation coefficients. Thus, the system

automatically responds to a change in such information if any, when reading in the information.

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BACKGROUND OF THE INVENTIONField of the Invention

The present invention relates to an assay system for an analysis system and more particularly, to an assay assisting system for an analysis slide, which can be suitably used to set up a standard curve (or standard calibration curve, or standard calculating curve), and to correct the standard curve by using lot-specific (or lot-dependent) information for an analysis slide to precisely analyze liquid samples such as blood samples.

Description of the Related Art

There are two main types of chemical analysis methods which are employed to assay (determine) the presence of a specific component, its content (its concentration or activity) or the like in a liquid sample such as a blood sample, that is, a dry type and a wet type. The dry-type method uses analysis slides each containing an analysis film (also called an analysis element or an analysis device unit) which has at least one reagent layer containing a specific reagent. A sample liquid is spotted (or dropped) onto an analysis slide, which is then placed in a reaction incubator to allow the reaction to progress. A reaction rate or a result of the reaction is detected and determined; for example, an optical density change of a color is determined by an optical densitometer. The dry-type analysis method is convenient because liquid samples can be handled like solid samples. Further, the assaying apparatus required for operating this method is normally small and easy to handle and operate. Therefore, the dry-type method is very widely employed.

In general, an apparatus used for the dry-type analysis method has a floppy disk (FD) or a ROM storing information necessary for photometry of colored analysis slides, calculation and display of results, for example: the standard curve; data processing methods such as an end point assay method and a rate assay method; an assaying time length; an amount of a sample to be spotted onto a slide; units for displaying results; and a range of values to be displayed. Thus, the apparatus performs various types of processing predetermined specifically for individual analytes (components to be determined) in accordance with the stored information. However, since such information regarding various analytes is stored as one unit in an FD or ROM, the FD or ROM usually needs to be changed if the type of slides used for analysis is changed (more specifically, if the composition of the reagent, the layer arrangement of the analysis films, the materials constituting the layers, or the

like is changed, thus changing determination methods, calculation methods, display methods or the like), or if a newly developed slide introducing a new analyte is used for assay.

5                         The inconvenience of changing FDs or ROMs can be eliminated if an assay system is constructed so that the necessary information can be inputted for each assaying process. Japanese Unexamined Patent Publication (Kokai) No. 59(1984)-10850 discloses such an assay system in which coded information necessary for assay, for example, information regarding analytes, wave lengths used for photometry, incubation time lengths and standard curves, is printed on a member supporting a test strip.

10                         However, since this system performs determination with reference to a standard curve obtained by using a standard optical density plate, the system may provide different measured values for different lots of the same kind of analysis slides. This is because the characteristics of different lots of the same type of analysis films of analysis slides vary in some cases even if the films have been produced under predetermined and controlled conditions.

15                         20                         To eliminate this problem, Japanese Unexamined Patent Publication No. 3(1991)-29838 proposes a system in which information regarding analysis films of each lot, such as coefficients of the standard curve thereof, which information is obtained beforehand, is provided on each casing of a kind of slide containing an analysis film of the lot, in a human readable form (i.e., alphabetical characters and numerals), information so that an operator can input the information to the assaying apparatus through a key board.

25                         30                         Japanese Unexamined Patent Publication 2-(1990)-257065 (corresponding to EP 0 353 589A) proposes another method for correcting fluctuations of measured or calculated values caused by possible lot-specific (lot-dependent) variations of characteristics of analysis slides. In this method, lot-specific fluctuations of measured or calculated values is corrected by using: reaction cartridges (one type of analysis slide) each carrying information, such as the lot identification number and the name of the specific analyte, expressed in human readable symbols (e.g., alphabetical characters and numerals) and optical codes (bar codes); and cards 35                         40                         each carrying information, such as information for correcting lot-specific variations of characteristics of an analysis reagent contained in each reaction cartridge, the lot identification number and the name of the specific analyte. This Japanese Unexamined Patent Publication does not specifically describe a method for calibrating a standard curve by using lot-specific correction data, but only states that a known method can be employed for this

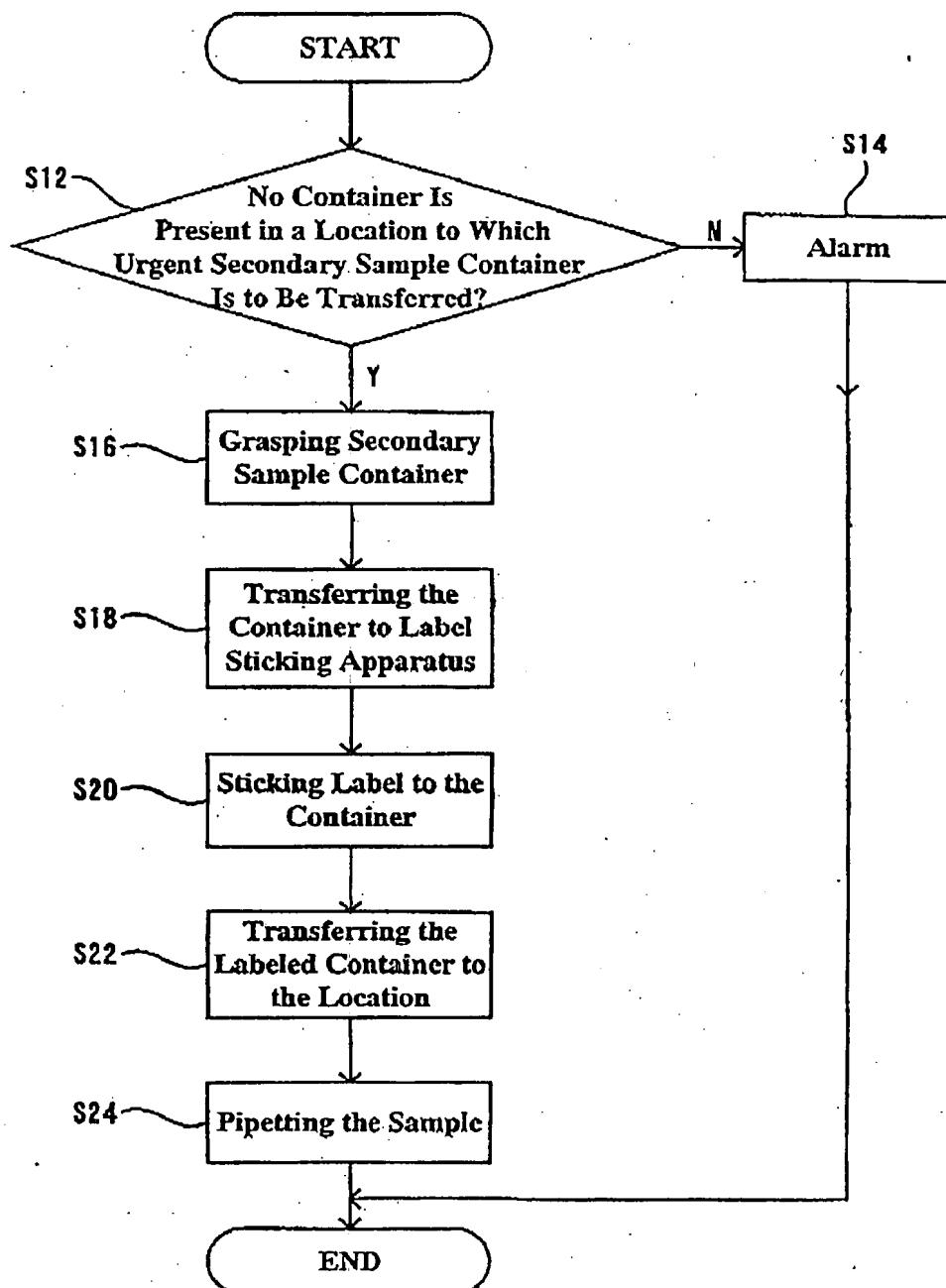


Fig. 2

purpose. Because the reaction cartridges (one type of analysis slide) used in this method are provided with the corresponding lot numbers by means of, for example, printing, the production cost of the reaction cartridges is inevitably increased. Further, this method is not very suitable for an analysis slide containing a highly sensitive analysis reagent. When lot numbers or the like are printed or heat-transferred onto an assembled analysis slide, the highly sensitive analysis reagent contained therein may be adversely affected (deteriorated or changed in characteristics) by a volatile solvent contained in the printing ink or heat provided during transference.

However, information which can be provided on a member supporting a test strip is limited to a rather small amount. Therefore, even the above system needs a ROM or floppy disk to store information having a large amount of data, such as information regarding complicated data processing methods. Then, the ROM or FD must be replaced with another ROM or FD in order to make such change. Significant inconvenience is incurred, such as packing, to safely and unfailingly deliver ROMs or FDs having necessary information to users throughout the country or the world. Further, some user may find it difficult to install the ROMs or FDs they receive. In principle, this kind of apparatus should be easy to handle and operate.

The amount of information required is further increased by a growing demand for enhancement of assay precision, as follows. If an equation of fourth degree is used to obtain a standard curve, then five coefficients are required. If correction of such a standard curve is performed by using a function of second degree, three coefficients are required. Since analytic curves are obtained from equations of fourth or fifth degree, five or six coefficients are required. Further, assay of some analytes require conversion of a measured value of optical density to an intermediate value and/or correction of coefficients for color fading.

Further, the amount of necessary information may be increased by a demand for selective display in the conventional units and SI units. Still further, if an assaying apparatus handles analysis slides requiring greatly different processing methods, the amount of information necessary to select the processing methods proportionally increases.

The amount of information is further increased by various options. For example, a usable period (shelf life period) of analysis slides is optionally determined beforehand and an alarm signal is generated when a slide older than the predetermined usable period is detected. Further, if production dates of slides are available or detectable and a coefficient for compensation for aging deterioration of characteristics of the slides is known, appro-

5 priate compensation can be made by using the number of days after the production and the compensation coefficient for aging deterioration. Still further, a threshold for determining an abnormal value outside the predetermined value range of each analyte may be stored.

10 Some of the above-mentioned information varies from one lot to another. If ROMs and/or FDs are used to make such variation, they must be frequently changed, causing substantial inconvenience to users. Further, the amount of information to be changed is large, it is difficult to make an optically readable code of the information and print the coded information on slides or the like, and further, a normal magnetic code will fail due to memory shortage of magnetic accommodation capacity.

#### SUMMARY OF THE INVENTION

20 Accordingly, an object of the present invention is to provide a system which performs assay using analysis slides in accordance with information about the assay stored in a magnetic card, the information including lot-specific (lot-dependent) correction information provided for each lot of slides.

25 To achieve this object, the present invention provides an assay system for analysis slides comprising: magnetic card reading means for reading the whole or a part of the information recorded on a magnetic card in such a manner that the information can be magnetically read, the information being information required for assay of a predetermined analyte, including fixed information including coefficients for completing a basic standard curve corresponding to an analysis slide having an analysis film which has a layer containing at least one reagent for assaying (determining) the value of the amount or the activity of an analyte, and variable information required for correcting a deviation in a measured value which is caused by the possible variation of characteristics of analysis films differing from one lot to another lot; and an assaying apparatus which, in accordance with information read by the magnetic card reading device, produces a standard curve corresponding to the lot of the analysis films represented by the magnetic card, by using the basic standard curve and other information belonging to the information read by the magnetic card reading device, performs calculation to obtain the amount (concentration) or activity of the analyte, and displays results of assay (i.e., calculating).

30 35 40 45 50 55 60 65 70 75 80 85 90 The assay system and the assaying apparatus of the present invention can be achieved by a correction method other than the above-described method in which the coefficients of a basic stan-

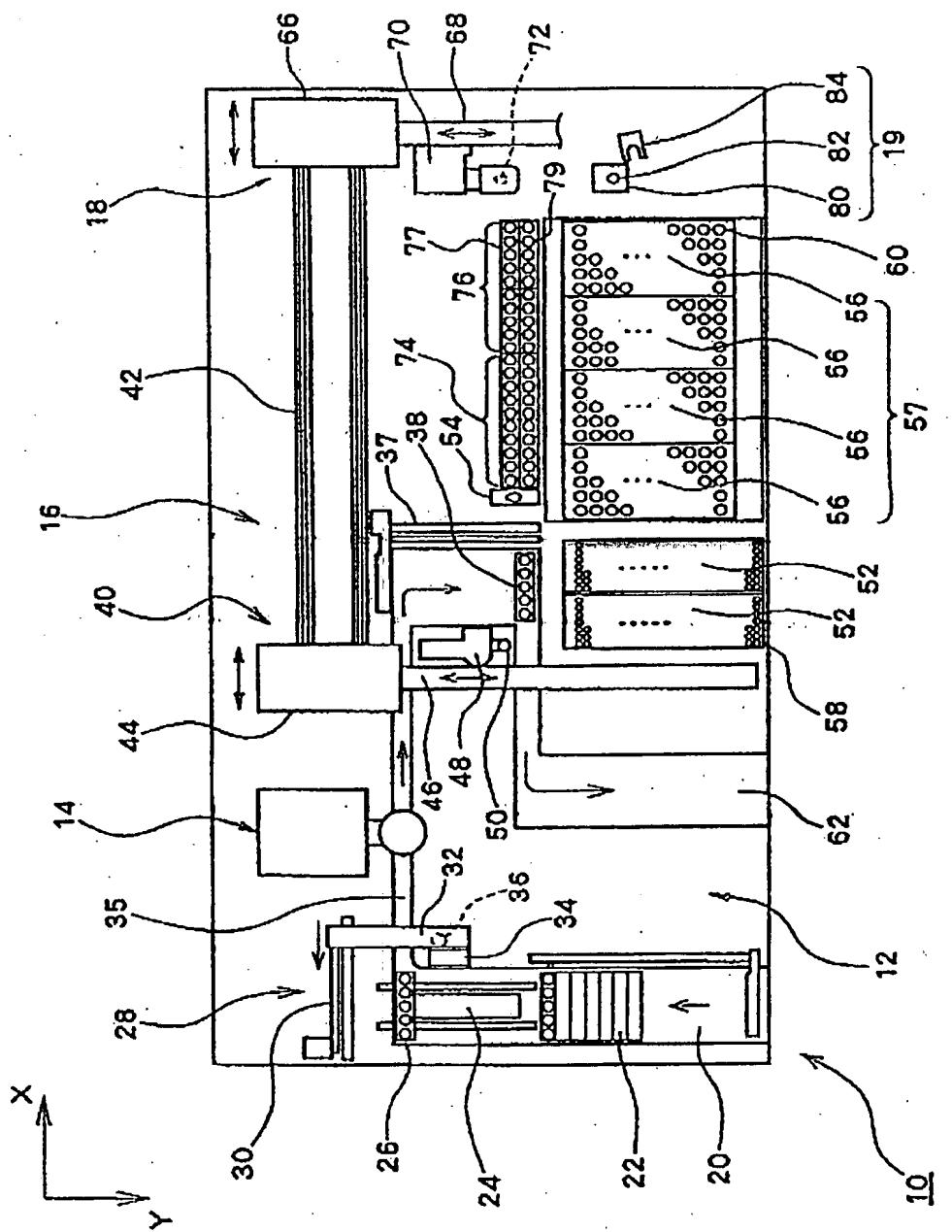


Fig. 4

dard curve expressed by an expression of a high degree is calibrated by using lot-specific correction data so as to obtain a lot-specific standard curve. For example, a basic standard curve is used without being calibrated by lot-specific correction data in order to calculate the amount (concentration) or activity of a specific analyte, then the calculated values of the amount (concentration) or activity are corrected by multiplying those values by correction coefficients obtained from lot-specific correction data through correction functions of a degree lower than the degree of the expression of the basic standard curve.

The assay system and the assaying apparatus of the present invention will be described hereinafter based on a correction method in which the coefficients of a basic standard curve are calibrated by lot-specific correction data. However, the assay system and the assaying apparatus of the present invention can be achieved on the basis of other correction methods, for example, a method which corrects correction functions for providing correction coefficients, instead of calibrating a basic standard curve.

Further, the present invention provides an assaying apparatus, which uses an analysis slide having an analysis film which has at least one layer containing a reagent for assaying (determining) a predetermined analyte, and calculates the amount (concentration) or activity of the predetermined analyte in accordance with a stored computer program in which a predetermined photometry and calculation processing method is written, comprising: storage means for reading fixed information including a basic standard curve corresponding to the analysis film of an analysis slide and/or variable information from a magnetic card as described below by using a magnetic card reading device which is provided either inside or outside the assaying apparatus; and a basic processing computer program written so as to complete the computer program regarding the photometry and calculation processing method for producing a lot-specific standard curve corresponding to the lot of the analysis film by using the basic standard curve and performing calculation to obtain the amount (concentration) or activity of the analyte by using the standard curve in accordance with the fixed information and the variable information stored in the storage means. The above-mentioned magnetic card carries information recorded on the magnetic card in such a manner that the information can be magnetically read in, the information being information required for assay of a predetermined analyte, including: fixed information including coefficients for completing a basic standard curve corresponding to the analysis slide having an analysis film which has a layer containing at least

one reagent for assaying the analyte; and variable information required for correcting a deviation in a measured value which is caused by the possible lot-specific variation of characteristics of analysis films differing from one lot to another lot,

According to the present invention, because information is coded for storage, an increased amount of information can be stored. Further, numerical information is packed (e.g., a number is packed into 4-bit data) when stored into the magnetic card, thus achieving increased storage density.

The stored information is read by the magnetic card reader and then inputted a memory (RAM) in accordance with programs stored in a floppy disk of the assaying apparatus. The magnetic card reader may be provided either separately from the apparatus or inside the apparatus. Photometry, calculation and data display are performed in accordance with the information inputted in accordance with the programs.

Each slide package contains one magnetic card, which is read by using the magnetic card reader when the slide package is opened. Thus, the magnetic cards facilitate operation and eliminate mistakes, thus achieving user friendliness.

Further objects, features and advantages of the present invention will become apparent from the following description of the invention with reference to the attached drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a general view of a preferred embodiment of the assaying apparatus (analyzer) equipped with the assay system for an analysis slide of the present invention.

Fig. 2 illustrates a preferred embodiment of the magnetic card of the present invention.

Figs. 3(A) and 3(B) illustrate a preferred embodiment of the analysis slide used in the assay system and the assaying apparatus of the present invention.

Fig. 4 is a block diagram of a control system of a preferred embodiment of the assaying apparatus (analyzer) equipped with the assay system of the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the present invention will be described hereinafter with reference to Figs. 1 to 4.

As shown in Fig. 1, an assay system according to the present invention comprises an assaying apparatus (analyzer) 2 and a magnetic card reader 3.



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(54) SAMPLE PRETREATMENT SYSTEM

(57)

ABSTRACT

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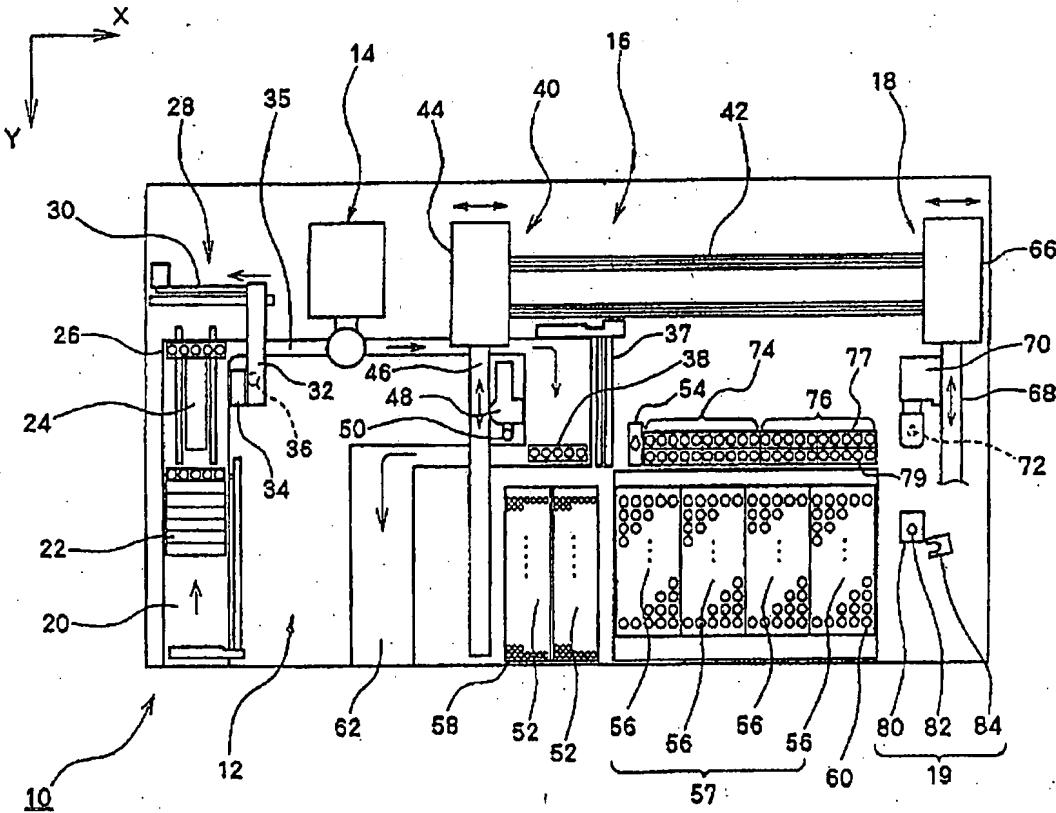
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A sample pretreatment system is provided with a pipetting table. On the pipetting table, there are provided on its front side a normal area 57 in which a plurality of normal secondary sample racks 56 are placed and on its back side an urgent area 76 in which a plurality of urgent secondary sample racks 77 are placed. Each of the normal secondary sample racks 56 holds a plurality of normal secondary sample containers 60 and each of the urgent secondary sample rack 77 holds a plurality of urgent secondary sample containers 79. In a normal pipetting mode, a sample is pipetted from a normal source sample container to the normal secondary sample containers 60, and in an urgent mode, a sample is pipetted from a source sample container to the urgent secondary sample containers 79. The urgent secondary sample rack 77 is formed into a portable type and has a size smaller than the normal secondary sample rack 56. According to this sample pretreatment system, secondary sample containers to which an urgent source sample has been pipetted can be located easily.



As shown in Fig. 2, a magnetic card 4 is about as large as a prepaid telephone card. The magnetic card 4 has a magnetic code recorded by a specific magnetic code recorder (not shown).

The magnetic card 4 stores two kinds of information: fixed information including coefficients for completing a basic standard curve corresponding to an analysis slide containing an analysis film which has at least one layer containing a reagent for a predetermined analyte; and variable information used to compensate fluctuation of photometric or calculated values caused by the possible variation of characteristics of analysis films which differ from one lot to another. The "fixed information" is invariable and basic information including: the code of a predetermined analyte; the name of the analyte, the amount of a liquid sample to be spotted (dropped) onto the analysis slide; a wave length used to measure the optical density of a color present in the analysis slide; a process for calculating data based on the optical density measured; a basic standard curve; a predetermined value range; a display range; the number of digits to be displayed; and the units for display. The "variable information" is information which may be varied, including: a lot number used for correction (or compensation) of fluctuation of measured or calculated values caused by the possible lot-specific variation in characteristics of analysis films which differ from one lot to another; and a correction coefficient of the standard curve predetermined for each lot. The variable information may further include a production date and a usable period (the expiration date of the contained reagent). The fixed information does not mean information which is absolutely fixed but information which does not need to be changed for every lot. Further, the fixed information is not limited to the above-listed types of information but can be suitably defined when an assay program is written.

The magnetic card issuer normally uses ASCII computer code to write information in the magnetic card 4, and it encodes or packs (e.g., pack a number into 4-digit data) numerical information in order to increase storage density. The magnetic card 4 may be made of either plastic or paper as long as it has a magnetic portion 5 for recording magnetic information. A surface of the magnetic card 4 may carry printed identification information, such as the name of a predetermined analyte 6, the lot number 7, the usable period 8 and correction coefficients 9. If such information is thus provided, the information can be visually confirmed.

A magnetic card 4 storing the above-mentioned information is provided for a package of analysis slides, and the information is stored in the assaying apparatus 2 by using the magnetic card reader 3 as a peripheral device, before assaying

operation using analysis slides (Fig. 1). The magnetic card reader 3 may also be provided inside the assaying apparatus 2.

The assaying apparatus 2 has a floppy disk driver (not shown) and a RAM, and thus can read the basic processing program for assaying process stored in a floppy disk and store it in the RAM. The basic processing program is written so as to read fixed information including coefficients for completing a basic standard curve corresponding to the analysis film of an analysis slide and/or lot-specific variable information, which may differ from one lot to another, from a magnetic card and to store it in storage means provided inside the assaying apparatus 2. Further, the basic processing program completes a computer program regarding a photometry and calculation processing to produce a lot-specific standard curve corresponding to the lot of the analysis films by using the basic standard curve and other information belonging to the fixed or variable information stored in the storage means and to calculate the amount (concentration) or activity of a predetermined analyte by using the standard curve. The basic processing program may be either stored in a RAM by reading it from a floppy disk using the floppy disk drive provided in the assaying apparatus, or stored in a ROM provided in the assaying apparatus. The fixed information and the variable information subsequently read from another magnetic card is stored in a floppy disk. If it is found that the slides are from the same lot as the previous slides, assaying process can be performed without reading the information of the magnetic card from the floppy disk to the RAM. Because one slide package contains slides of the same lot, reading of the magnetic card is required only once when the container is opened, and further reading of the magnetic card is unnecessary as long as the slides from the same container are processed.

Figs. 3(A) and 3(B) illustrate the front and back sides, respectively, of an analysis slide 10. The back side of the analysis slide 10 carries a bar code 11 indicating the analyte of the analysis slide 10. When the analysis slide 10 is put in the assaying apparatus 2, the bar code 11 is read by an optical sensor (a bar code reader) which is provided near conveying mean for conveying analysis slides from a slide loading site to a sample spotting site, thus identifying the analyte of the analysis slide 10. Then, photometry is performed for the analysis slide 10 and, then, the obtained data (value of the optical density) is processed and calculated, in accordance with the computer program regarding the photometry and calculation processing, which program has been written using the fixed information and the variable information read in from the magnetic card corresponding to the

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applied to the case where urgent secondary sample containers are in advance placed in the urgent secondary sample rack.

[0056] According to the sample pretreatment system of the present invention, since it is not necessary to look for and select the secondary sample containers to which an urgent source sample has been pipetted, the burden of the user can be reduced. Further, according to the sample pretreatment system of the present invention, it is also possible to send the secondary sample containers to which an urgent source sample has been pipetted to the next stage immediately.

[0057] Finally, it is needless to mention that the present invention is not limited to the above-described embodiments but can be modified or improved in various ways within the scope described in claims.

What is claimed is:

1. A sample pretreatment system, comprising:

a pipetting nozzle for pipetting a sample from a source sample container to secondary sample containers;

a nozzle conveying apparatus for conveying the pipetting nozzle;

a normal area in which at least one normal secondary sample rack which holds a plurality of normal secondary sample containers is placed;

an urgent area in which at least one urgent secondary sample rack which holds a plurality of urgent secondary sample containers is placed; and

control means for controlling the pipetting nozzle and the nozzle conveying apparatus, the control means controls the pipetting nozzle and the nozzle conveying apparatus so that in a normal pipetting mode a sample from the source sample container is pipetted to the secondary sample containers, and in an urgent pipetting mode a sample from the source sample container is pipetted to the urgent secondary sample containers.

2. The sample pretreatment system as claimed in claim 1, further comprising a pipetting table on which the normal area and the urgent area are provided, the pipetting table

having a front side and a back side, in which the normal area is provided on the front side of the pipetting table and the urgent area is provided on the back side of the pipetting table.

3. The sample pretreatment system as claimed in claim 1, wherein the urgent secondary sample rack is formed into a portable type, and has a size smaller than the normal secondary sample container.

4. A sample pretreatment system, comprising:

a pipetting nozzle for pipetting a sample from a source sample container to secondary sample containers;

a nozzle conveying apparatus for conveying the pipetting nozzle;

a normal area in which at least one normal secondary sample rack which holds a plurality of secondary sample containers is placed;

an urgent area in which at least one urgent secondary sample rack which holds a plurality of urgent secondary sample containers is placed;

a container transferring apparatus for carrying out container transfer by which a unused normal secondary sample container in the normal secondary sample rack is transferred to the urgent secondary sample rack as an urgent secondary sample container; and

control means for controlling the pipetting nozzle, the nozzle conveying apparatus and the container transferring apparatus so that in a normal pipetting mode a sample from the source sample container is pipetted to the secondary sample containers, and in an urgent pipetting mode the container transfer is carried out, and after the container is transferred, a sample from the source sample container is pipetted to an urgent secondary sample container which has been transferred from the normal secondary sample rack.

5. The sample pretreatment system as claimed in claim 4, further comprising means for stacking a label onto the container during the transfer of the container.

\* \* \* \* \*

analysis slide 10. Instead the bar code 11, the analysis slide 10 may carry a carura code (one type of optical code which can express a hexadeciml code) or a magnetic code.

Fig. 4 is a block diagram of a control system of a preferred embodiment of the assaying apparatus equipped with the assay system of the present invention. To read in magnetic information of a magnetic card into an assaying apparatus by using a magnetic card reader, the magnetic card key of the key board of the assaying apparatus is pressed, and then the magnetic card is slid through the magnetic card reader. The fixed information and/or variable information read from the magnetic card is stored in a floppy disk and/or the RAM. A lot-specific standard curve corresponding to the analyte is obtained by using the basic standard curve and the values of coefficients contained in the fixed and variable information. Then, the optical density of the analysis slide is measured and calculated to obtain the amount (concentration) or activity of the analyte, by using the lot-specific standard curve.

The analysis operation using the assay system for analysis slides, the assaying apparatus and the magnetic card of the present invention will be described hereinafter. An analysis slide set in the assaying apparatus is conveyed, by conveying means driven by a stepping motor, to a sample-spotting site, and then into an incubator where the predetermined substantially constant temperature is maintained. During conveyance, a bar code reader provided in the assaying apparatus reads the bar code printed on the analysis slide, thus identifying the analyte. Then, the sample is spotted onto an analysis slide by using a pipet. While the analysis slide is held in the incubator, the optical density of the analysis slide (analysis film) is measured by photometry means using an optical sensor a predetermined time after spotting of the sample liquid. The obtained optical density is processed (calculated) to obtain the amount (concentration) or activity of the analyte, in accordance with the data processing corresponding to the analyte. This data processing (e.g., calculation and correction) is performed by using information read from the magnetic card. The amount (concentration) or activity of the analyte is outputted to a display and a printer. Optionally, the amount (concentration) and activity of the analyte and, if desired, the optical density thereof can be sent out through a send/receive control interface.

Although the information of the magnetic card is read before assay operation of the corresponding analysis slides in normal operation, it can be read in during the assay operation if an analysis slide of a different lot is used. In such a case, an interruption time of photometry and data process-

ing must be minimum so as to reduce adverse effects on the photometry and data processing to minimum. This can be achieved by providing an identification number for each set of fixed information and writing a basic computer program so that the identification number of the set of fixed information read in from the current magnetic card is compared with the identification number of the set of the fixed information read in from the previous magnetic card and, if the identification numbers are the same, only the variable information of the current magnetic card is read in and stored. Further, a basic computer program may be written so that, if there is a large amount of variable information to be read in, reading of the variable information is prohibited during an assaying process. Still further, a floppy disk containing fixed information may be used, and only variable information is read in from magnetic cards as long as no fixed information different from the fixed information stored in the FD is found. Further, inappropriate correction can be prevented, for example, if the bar code of each analysis slide contains a number identifying the kind of the variable information and when a number different from the number previously read in and stored is found, an alarm signal is produced.

The fixed information including: the amount of a sample to be spotted, the wave length for photometry, the method of data processing (that is, processing and/or calculating of the obtained optical density data), a basic standard curve, a range of the amount or activity of an analyte; a display range, the number of digits to be displayed, and display units, is not frequently changed in normal operation. This information can be read in and stored just by sliding a magnetic card through the magnetic card reader, even if there is a change in fixed information.

If the storability of analysis slides is poor, periodical calibration is required. Correction can be made by calibration using a basic standard curve as a standard calibration curve. The fixed information of a magnetic card may include a set of information determining whether or not calibration is required.

The assay system for analysis slides and the assaying apparatus of the present invention can handle not only dry-type analysis slides having dry-type analysis films or test strips but also packs containing wet-type reagents (i.e., solutions of reagents). Further, although the above-described embodiments employ colorimetry method, the assay system and the assaying apparatus of the present invention can employ various electrochemical sensors (e.g., ion-selective electrodes and FET sensors), various electro-biochemical sensors, photoelectric sensors, photo-electrochemical sensors, etc.

label sticking device 80 prepares predetermined labels which will be stuck to secondary sample containers, and sticks a label to a secondary sample container received by the container holding device 82. In the label sticking process, data of the source sample container obtained at the label reading position 26 are transmitted so that this process can be carried out in parallel with the pipetting operation.

[0047] By repeatedly carrying out the series of the processes described above, it is possible to carry out pipetting of a source sample and label sticking efficiently.

[0048] Hereinbelow, a detailed description will be made with regard to the urgent pipetting mode. When it is necessary to pipet a sample from a source sample container urgently, a user inputs pipetting information which indicates that an urgent pipetting should be carried out into the system. In addition to this, an urgent source sample rack which holds an urgent source sample container containing an urgent source sample is placed in the rack receiving portion 20. The urgent source sample is fed along the conveying path to be set at the label reading position 26 according to the operation of the source sample rack conveying apparatus 12. At the label reading position 26, a label attached to the urgent source sample container is read by the label reader 34, and the read out data is transmitted to the control section not shown in the drawings, and then the data is compared with the pipetting information inputted by the user to be recognized as the source sample container being an urgent source sample container. At that time, the control mode of this system for this urgent source sample container is changed into the urgent pipetting mode, and therefore conveyance of the urgent source sample and preparation of urgent secondary sample containers are carried out in a parallel operation.

[0049] Next, based on the flow chart shown in FIG. 2, an explanation will be made with regard to the procedures for the preparation of the urgent secondary sample containers and the pipetting operation in the urgent mode. In this regard, it is to be noted that FIG. 3 shows the operations of the manipulator 72 and the pipetting nozzle 50 according to the procedures shown in FIG. 2. In FIG. 3, the motions of the manipulator 72 are shown by solid lines and the motions of the pipetting nozzle 50 are shown by dotted lines, and the corresponding steps in the procedures are indicated by the step number such as S12 and the like.

[0050] When the urgent pipetting is to be carried out, no secondary sample containers to which a sample is to be pipetted are prepared in the urgent area 76. Therefore, it is necessary to transfer urgent secondary sample containers to the urgent secondary sample rack 77. Therefore, at the first step, confirmation is made by the manipulator 72 as to whether or not there are any holes for supporting urgent secondary sample containers in the urgent secondary sample rack 77 (that is, there are any locations to which the urgent secondary sample containers are to be transferred), or as to whether or not other urgent secondary sample containers have already held therein (Step S12). In more details, in this step, the manipulator 72 is moved above the position where the secondary sample container is to be transferred, and at that position the manipulator 72 performs a gripping operation to confirm presence or absence of other urgent secondary sample container. When such other urgent secondary sample container is already existed, it is detected by a gripping force sensor of the manipulator 72. At that time,

alarm is given (Step S14), and then the user removes the already existed urgent secondary sample container.

[0051] Where it is confirmed that there are no container at the location to which the urgent secondary sample container is to be transferred, the manipulator 72 is moved to a position above an unused normal secondary sample container in the normal secondary sample rack 56 according to the pipetting information to grasp the secondary sample container as an urgent secondary sample container 79 (Step S16). In this regard, the control section not shown in the drawings may instruct which unused normal secondary sample container is used as an urgent secondary sample container each time upon receiving the pipetting information, or it is also possible to determine such a container in advance. For example, it is possible to determine that unused normal secondary sample containers arranged in the last row of the normal secondary sample rack 77 are used as urgent secondary sample containers one by one from the last container in the row.

[0052] Next, the manipulator 72 transfers the urgent secondary sample container 79 to the label sticking apparatus 19 (Step S18) The label sticking apparatus 19 sticks a predetermined label to the container according to the pipetting information. After sticking the label, the manipulator 72 holds the labeled urgent secondary sample container 79 again to transfer it to a designation hole in the urgent secondary sample rack 77 (Step S22). When a plurality of urgent secondary sample containers are used, the steps from S16 to S22 are repeated for times corresponding to the number of the urgent secondary sample containers.

[0053] During the above operations, an urgent source sample container is fed along the belt line 35 to the cap opening unit 14, and after the cap is removed by the cap opening unit 14, the urgent source sample container is fed to the pipetting position 38. Namely, the conveyance of the source sample container and the preparation of the urgent secondary sample containers are carried out in parallel. This realizes an effective urgent pipetting operation. When the urgent source sample is set at the pipetting position 38 and the labeled urgent secondary sample container 79 is held by the urgent secondary sample rack 77, a source sample is aspirated from the urgent source sample container by the pipetting nozzle 50, and then the sample is dispensed to the urgent secondary sample container 79 to carry out pipetting operation (Step S24). When the pipetting operation has been carried out for all the urgent secondary sample containers 79, the urgent source sample container is fed to the discharge section 62 and then carried to the outside.

[0054] When the urgent pipetting is completed in this way, an alarm is given. Then, the user takes out the urgent secondary sample container 79 or the urgent secondary sample rack 77 in the urgent area 76. Since the urgent area 76 is provided separately from the normal area 57, it is possible to easily locate and take out the urgent secondary sample containers 79 without looking for and selecting them. Further, since the urgent secondary sample rack 77 is formed into a portable type and has a smaller size than the normal secondary sample rack, handling thereof is easy.

[0055] In the foregoing, a description is made with regard to the case where no urgent secondary sample containers are prepared in the urgent area, the present invention can be

As described above, in the assay system of the present invention, the fixed information and lot-specific variable information which may differ from one lot to another is stored in magnetic cards, and each slide package contains such a magnetic card, and the information is read in by the magnetic card reader. Therefore, to operate the system, a user (an operator) does not need to worry about a change in the fixed and variable information. Instead, the system responds to such a change when reading fixed and variable information. Thus, the assay system for analysis slides and the assaying apparatus of the present invention are easy to operate.

### Claims

**1. An assay system for analysis slides comprising:**

magnetic card reading means for reading the whole or a part of the information recorded on a magnetic card in such a manner that said information can be magnetically read, said information being information required for assay of a predetermined analyte, including: fixed information including coefficients for completing a basic standard curve corresponding to an analysis slide having an analysis film which has a layer containing at least one reagent for assaying said analyte, and variable information required for correcting a deviation in a measurement which is caused by the possible lot-specific variation of characteristics of analysis films differing form one lot to another lot; and

an assaying apparatus which, in accordance with information read in by said magnetic card reading device, produces a lot-specific standard curve corresponding to the lot-specificity of the analysis films represented by said magnetic card, by using said basic standard curve and other information belonging to said information read in by said card reading device, performs calculation to obtain the concentration or activity of said analyte, and displays results of assay.

**2. A magnetic card, which carries information recorded on said magnetic card in such a manner that said information can be magnetically read in, said information being information required for assay of a predetermined analyte, including: fixed information including coefficients for completing a basic standard curve corresponding to the analysis slide having an analysis film which has a layer containing at least one reagent for assaying said analyte; and variable information required for correcting a deviation in a measurement which is caused**

by the possible lot-specific variation of characteristics of analysis films differing form one lot to another lot.

- 5     **3. An assaying apparatus, which uses an analysis slide having an analysis film which has at least one layer containing a reagent for assaying a predetermined analyte, and calculates the concentration or activity of said predetermined analyte in accordance with a stored computer program in which a predetermined photometry and calculation processing method is written, comprising:**
- 10     storage means for reading fixed information including coefficients for completing a basic standard curve corresponding to the analysis film of an analysis slide and/or variable information from a magnetic card as defined in Claim 2, by using a magnetic card reading device which is provided either inside or outside said assaying apparatus; and
- 15     a basic processing computer program written so as to complete said computer program regarding said photometry and calculation processing method for producing a lot-specific standard curve corresponding to the lot-specificity of said analysis film by using said lot-specific standard curve and performing calculation to obtain the concentration or activity of said analyte by using said lot-specific standard curve in accordance with said fixed information and said lot-specific variable information stored in said storage means.

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inside the nozzle tip by operating and controlling the pipetting pump. For example, when subdividing a source sample to three secondary sample containers, the predetermined amount would be the total amount necessary for creating three secondary samples.

[0038] Next, with the predetermined amount of source sample being held inside the nozzle tip, the pipetting nozzle 50 is raised to a predetermined height, and then the pipetting nozzle 50 is moved so that it is positioned directly above a secondary sample container 60 to which the source sample is to be pipetted. In this regard, it is to be noted that in the normal pipetting mode, a secondary sample container to which the source sample is to be pipetted is a normal secondary sample container held in the normal secondary sample rack 56, and in the urgent pipetting mode, a secondary sample container to which the sample is to be pipetted is an urgent secondary sample container 79 held in the urgent secondary sample rack 77 placed in the urgent area 76. A control section now shown in the drawings designates these containers to which the source sample is to be pipetted. Then, the pipetting nozzle 50 is lowered at this position, and a predetermined amount of the source sample held inside the pipetting nozzle is dispensed by operating and controlling the pipetting pump. This sequence is then repeated to subdivide the source sample from one source sample container to a predetermined number of unused secondary sample containers.

[0039] When the pipetting operations for the source sample in one source sample container are completed, the pipetting nozzle 50 is moved in a horizontal direction so that the pipetting nozzle 50 is positioned directly above the tip remover 54. Then, the nozzle 50 is lowered, and after the used nozzle tip is hooked by the tip remover 54, the pipetting nozzle 50 is raised to a predetermined height, whereby the used tip is removed from the nozzle base and falls into the tip disposal container arranged directly below the tip remover 54. Next, a new unused nozzle tip is attached to the nozzle base as described above, and the same sequence for pipetting a source sample from the next source sample container is carried out repeatedly.

[0040] When predetermined pipetting operations have been carried out from all the source sample containers arranged in one source sample rack, such source sample rack is conveyed along a conveying path and sent to a discharge section 62, and then the source sample rack is carried to the outside automatically or manually.

[0041] Next, a description will be given for the container conveying apparatus 18. The container conveying apparatus 18 is a mechanism which freely conveys a container held by a manipulator in the three axial directions of the X-axis, the Y-axis and the Z-axis. The container conveying apparatus 18 is equipped with the two second guide rails 42 arranged in the X-axis direction which are also utilized by the nozzle conveying mechanism 40, a second base 66 which can move in the X-axis direction on the second guide rails 42, a second Y-axis arm 68 which is integrally formed with the second base 66 to extend in the Y-axis direction, and a manipulator pedestal 70 which can move in the X-axis direction along the second Y-axis arm 68, wherein a manipulator 72 is provided on the manipulator pedestal 70. The manipulator 72 is movable. In the Z-axis direction with respect to the manipulator pedestal 70.

[0042] Because the second guide rails 42 are utilized by both the container conveying apparatus 18 and the nozzle conveying mechanism 40, the area where the manipulator 72 can be moved covers a wide area up to the source sample rack at the pipetting position. Therefore, by using the manipulator 72, it is possible to convey containers to an abnormal source sample elimination area 74, the urgent area 76 and the label sticking apparatus 19 which are provided inside the area of such movement, respectively.

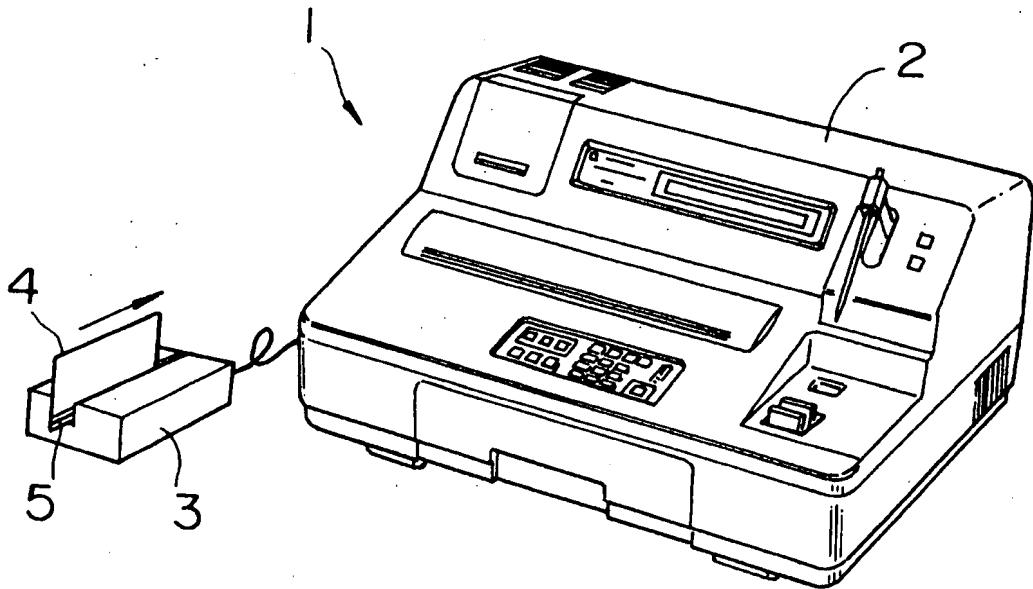
[0043] The abnormal source sample elimination area 74 is an area for receiving a source sample container containing a sample recognized as an abnormal source sample. The cases where a source sample is recognized as an abnormal source sample can include cap opening mistakes, pipetting mistakes and the like in addition to the case where there are label reading errors or errors in the recognition of the presence or absence of a container at the label reading position 26, for example. The source sample container recognized as containing such an abnormal source sample is temporarily sent to the pipetting position 38. Then, by operating the container conveying apparatus 18 in accordance with Instructions from a control section not shown in the drawings, the manipulator 72 is moved directly above the abnormal source sample container at the pipetting position 38, and after being lowered to grasp the abnormal source sample container, the manipulator 72 is raised to a predetermined height and then moved directly above the abnormal source sample elimination area 74. Then, the manipulator 72 is lowered at the position of a predetermined container holding location inside the abnormal source sample elimination area 74, and the grip is released to store the abnormal source sample container at such a location.

[0044] Further, in the urgent area 76, the urgent secondary sample rack 77 is placed, as described above. Before receiving the secondary sample containers, there is no container in this area 76. Therefore, the manipulator 72 grasps an unused normal secondary sample container from the normal secondary sample rack 56, and conveys it to the label sticking apparatus 19 as an urgent secondary sample container 79 according to control by a control section not shown in the drawings. After the label sticking apparatus 19 sticks a predetermined label on the urgent secondary sample container 79, the manipulator 72 conveys the urgent secondary sample container 79 to which the label has been stuck from the label sticking apparatus 19 to the urgent secondary sample rack 77. In this way, it is possible to transfer an unused normal secondary sample container from the normal secondary sample rack 56 to the urgent secondary sample rack 77 as an urgent secondary sample container 79.

[0045] Alternatively, it is also possible to pipet a sample in an urgent source sample container to secondary sample containers in the normal secondary sample rack 56, and after the pipetting of the sample has been carried out, the secondary sample container to which the sample has been pipetted is transferred from the normal secondary sample rack 56 to the urgent secondary sample rack 77 as an urgent secondary sample container 79 using the manipulator 72.

[0046] Next, a description will be made with regard to the label sticking apparatus 19. The label sticking apparatus 19 is equipped with a label sticking device 80 and a container holding device 82, and cooperates with a transfer mechanism 84 for conveying secondary sample containers. The

FIG. I



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[0025] The source sample rack 22 having the containers of which labels have been read out by the label reader 34 is then conveyed to the position of the cap opening unit 14 by a belt line 35 which moves in the X-axis direction. The cap opening unit 14 carries out a cap opening operation on each container. Namely, because a container such as a blood sample vial is provided with a rubber cap or the like to prevent contamination, the cap is removed by the cap opening unit 14 before pipetting operation.

[0026] The source sample rack 22 that has undergone the cap opening operation is conveyed further along the X-axis direction by the belt line 35, and then this source sample rack 22 is moved in the Y-axis direction and set at a pipetting position 38 by a setting mechanism 37.

[0027] As described above, by the cooperation of the source sample rack conveying apparatus 12 and the cap opening unit 14, the source sample rack placed in the rack receiving portion 20 is fed to the label reading position at which labels attached to the source sample containers are read out, then fed to the cap opening unit 14 at which the caps of the containers are removed, and then set at the pipetting position 38 for pipetting operation.

[0028] The above described processes are the common for a normal pipetting mode in which a normal pipetting operation is carried out and an urgent pipetting mode in which pipetting operation for an urgent source sample is carried out. In this regard, however, please note that in the urgent pipetting mode, a source sample contain is recognized as an urgent source sample container by reading a label attached thereto, and based on the readout information a control section not shown in the drawings carries out a different control for the subsequent pipetting operation.

[0029] Next, a description will be made with regard to the pipetting apparatus 16. The pipetting apparatus 16 includes a nozzle conveying mechanism 40 which can convey the nozzle freely in the three axial directions of the X-axis, the Y-axis and the Z-axis. The nozzle conveying mechanism 40 is equipped with two second guide rails 42 arranged in the X-axis direction, a first base 44 which can move in the X-axis direction on the second guide rails 42, a first Y-axis arm 46 which is integrally formed with the first base 44 to extend in the Y-axis direction, and a nozzle pedestal 48 which can move in the X-axis direction along the first Y-axis arm 46, wherein a pipetting nozzle 50 is provided on the nozzle pedestal 48. The pipetting nozzle 50 is movable in the Z-axis direction with respect to the nozzle pedestal 48. The pipetting nozzle 50 is constructed from a nozzle base and a nozzle tip which is removably attached to the nozzle base. Further, the nozzle pedestal 48 is also provided with a pipetting pump connected to the pipetting nozzle 50 with a piping tube or the like. Of course, the pipetting pump may be separately arranged outside the nozzle pedestal 48.

[0030] Further, the above-described pipetting position 38 is established inside the space in which the pipetting nozzle 50 can be conveyed by the nozzle conveying mechanism 40. Inside this space, there are provided a plurality of tip racks 52, a tip remover 54, a normal area 57 in which normal secondary sample racks 56 are to be placed and an urgent area 76 in which urgent secondary sample racks 77 are to be placed.

[0031] Each of the tip racks 52 holds a plurality of rows of unused nozzle tips 58. These tips are arranged so that the tip head openings in which the nozzle base is inserted are facing upward.

[0032] Namely, the unused nozzle tips 58 are arranged with their tip head openings facing upward to enable the unused nozzle tips 58 to fit onto the nozzle base when the nozzle base is lowered in the Z-axis direction. It is possible to provide a plurality of tip racks 52 according to the treatment capacity of the system.

[0033] The tip remover 54 hooks onto each of the used nozzle tips to remove it from the nozzle base. A tip disposal container not shown in the drawings is arranged directly below the tip remover 54, and the removed used nozzle tips are disposed of by being dropped into the tip disposal container.

[0034] The normal area 57 is an area in which normal secondary sample racks used in the normal pipetting mode are placed, and this area is provided on the front side of a pipetting table. Here, please note that the pipetting table means a working table on which the normal secondary sample racks 56, the tip racks 52, the urgent secondary sample racks 77 and the like are placed, and the front side of the pipetting table means the side of the table where an operator stands. In the normal area 57, at least one normal secondary sample rack 56 which holds a plurality of normal secondary sample containers 60 is placed. In the example shown in FIG. 1, four normal secondary sample racks 56 are placed. When the system begins operation or when the normal secondary sample racks are to be replaced, an operator sets a plurality of normal secondary sample racks 56 holding only unused secondary sample containers in the normal area from the front side of the pipetting table.

[0035] The urgent area 76 is an area in which urgent secondary sample racks 77 are placed, and this area is provided on the back side of the pipetting table. In this urgent area 76, at least one urgent secondary sample rack 77 is placed. Each urgent secondary sample rack 77 holds a plurality of urgent secondary sample containers 79. In the example shown in FIG. 1, four urgent secondary sample racks 77 each holding five urgent secondary sample containers 79 are placed in the urgent area 76. Each urgent secondary sample rack 77 is formed into a portable type and has a size smaller than the normal secondary sample rack 56.

[0036] The pipetting sequence is carried out as follows under the control of a control section not shown in the drawings. First, operations start in a state in which a nozzle tip is not attached to the nozzle base. Accordingly, the nozzle conveying mechanism 40 is operated to move the nozzle base in a horizontal direction to a position directly above the tip rack 52. Then, the nozzle base is lowered toward the tip head opening of one unused nozzle tip 58 selected from the group of unused nozzle tips 58 until the nozzle base is pushed into the tip head opening of such selected unused nozzle tip 58, whereby the pipetting nozzle 50 is formed. Next, the pipetting nozzle 50 is raised to a prescribed height, and then the pipetting nozzle 50 is moved in a horizontal direction to a position directly above a source sample container containing a source sample to be pipetted at the pipetting position 38. In this way, preparation for the pipetting operation is setup.

[0037] Next, the pipetting nozzle 50 is lowered, and then a predetermined amount of the source sample is aspirated

FIG. 2

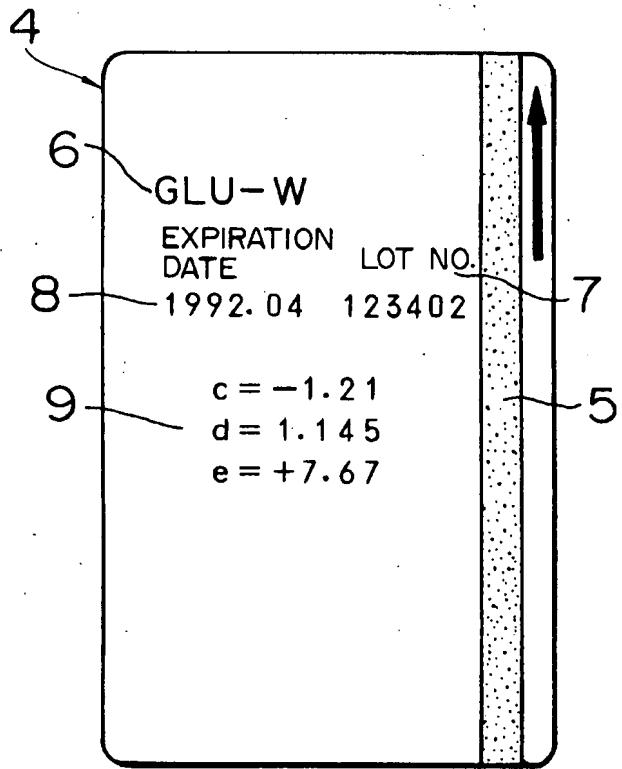


FIG. 3(A)

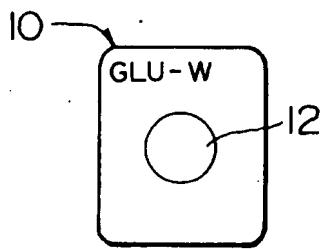
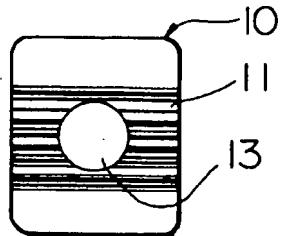


FIG. 3(B)



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urgent secondary sample rack to be formed into a portable type having a small size because handability is good and feeding to the next stage can be made easily.

[0013] Another aspect of the present invention is also directed to a sample pretreatment system. This sample pretreatment system comprises: a pipetting nozzle for pipetting a sample from a source sample container to secondary sample containers; a nozzle conveying apparatus for conveying the pipetting nozzle; a normal area in which at least one normal secondary sample rack which holds a plurality of secondary sample containers is placed; an urgent area in which at least one urgent secondary sample rack which holds a plurality of urgent secondary sample containers is placed; a container transferring apparatus for carrying out container transfer by which a unused normal secondary sample container in the normal secondary sample rack is transferred to the urgent secondary sample rack as an urgent secondary sample container, and control means for controlling the pipetting nozzle, the nozzle conveying apparatus and the container transferring apparatus so that in a normal pipetting mode a sample from the source sample container is pipetted to the secondary sample containers, and in an urgent pipetting mode the container transfer is carried out, and after the container is transferred, a sample from the source sample container is pipetted to an urgent secondary sample container which has been transferred from the normal secondary sample rack.

[0014] According to this structure, when a sample is required to be pipetted urgently, it is not necessary to prepare urgent secondary sample containers in advance separately from the normal secondary sample containers, and unused normal secondary sample containers held in the normal secondary sample rack can be used as urgent secondary sample containers.

[0015] In this case, preferably, the label sticking is carried out during the transfer of the container. According to this, it is no longer necessary to stick a label after the transfer of the container is completed, thereby enabling to simplify the steps for preparation for the urgent secondary sample containers.

[0016] The above and other objects, structures and advantages of the present invention will be more apparent when the following detailed description of the embodiment is considered in conjunction with the appended drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a top view which shows the overall structure of one embodiment of a sample pretreatment system according to the present invention.

[0018] FIG. 2 is a flow chart which shows the process of preparing urgent secondary sample containers and carrying out pipetting operation in the embodiment of the sample pretreatment system of the present invention.

[0019] FIG. 3 is an illustration which shows the movements of a manipulator and a pipetting nozzle in an urgent pipetting mode in the embodiment of the sample pretreatment system of the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] The preferred embodiments of the present invention will now be described in detail with reference to the drawings.

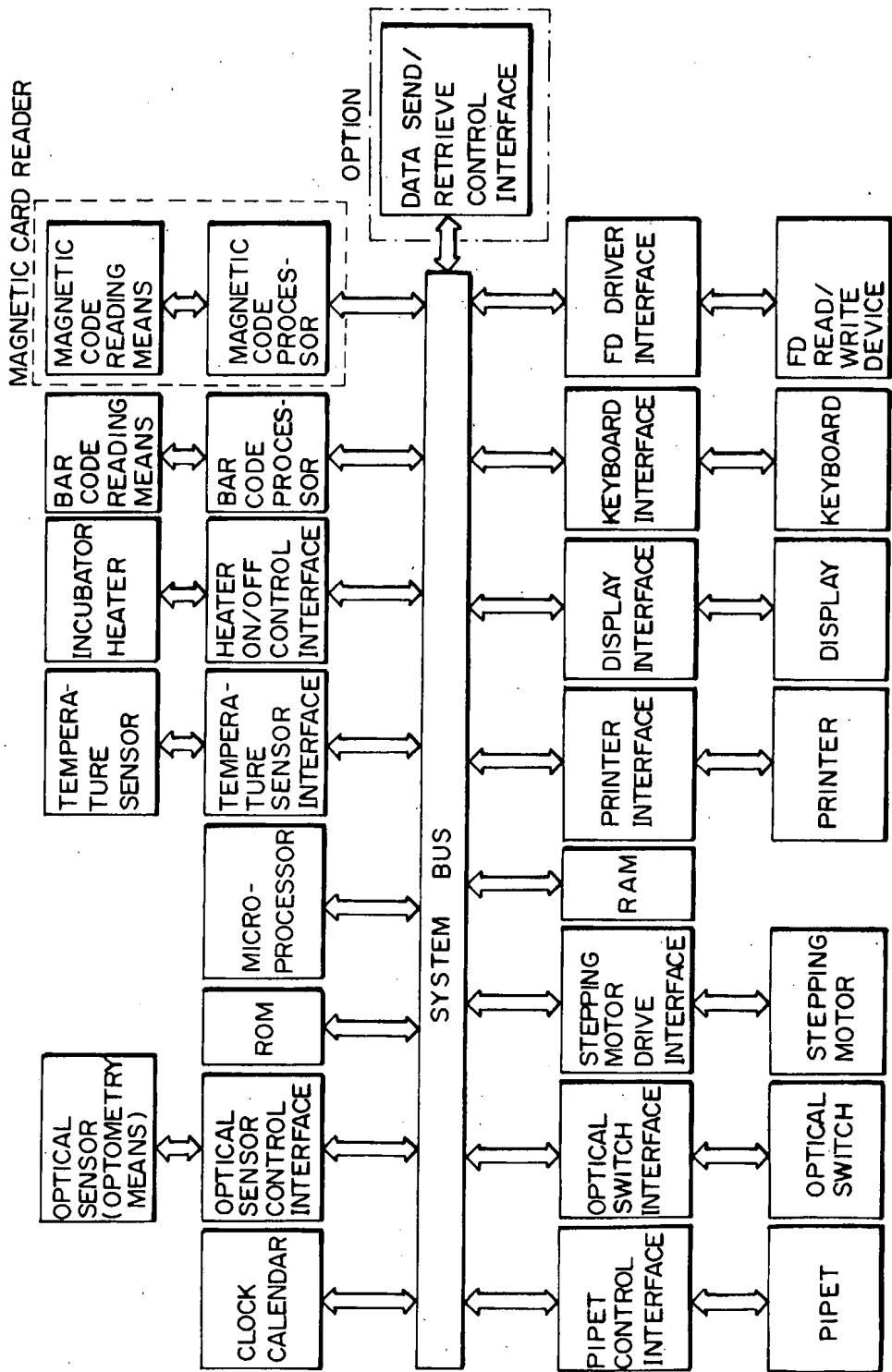
[0021] FIG. 1 is a top view which shows the overall structure of a sample pretreatment system 10. The sample pretreatment system 10 is equipped with a source sample rack conveying apparatus 12 which sequentially conveys source sample racks in which source sample containers are arranged to a pipetting position, a cap opening unit 14 which removes the cap of a source sample container for enabling pipetting operation to be carried out, a pipetting apparatus 16 which uses a nozzle and a pipetting pump to subdivide (pipette) the source sample in the source sample container to a plurality of secondary sample containers arranged in a secondary sample rack, a container conveying apparatus 18 which conveys containers, and a label sticking apparatus 19 which sticks labels on containers. The control of all the operations of the sample pretreatment system 10 is carried out by a control section not shown in the drawings, and all the operations of the sample pretreatment system 10 are displayed on a display not shown in the drawings. The X-axis direction and the Y-axis direction are shown in FIG. 1 to make it easy to understand the conveying direction of the source sample rack and the like. The Z-axis direction is orthogonal to the plane of the paper.

[0022] Source sample racks 22 are placed in a rack receiving portion 20 of the source sample rack conveying apparatus 12 by a manual operation or by the use of a separate apparatus. The source sample racks 22 are placed in the rack receiving portion 20 so that the longitudinal direction of each rack is directed to the X-axis direction. The placed source sample racks 22 are fed forward along a feeding path in the Y-axis direction by a feeding mechanism. A rack separation mechanism 24 provided at a predetermined separation position separates the head source sample rack 22 from the placed source sample racks 22. The separated source sample rack 22 is moved by the moving mechanism in the Y-axis direction to a label reading position 26, and is set at such position.

[0023] The source sample rack conveying apparatus 12 has a detection unit conveying mechanism 28 which includes a moving arm 32 which can move along a first guide rail 30 in the X-axis direction. The moving arm 32 extends over the top of the source sample rack 22 set at the label reading position 26, and a label reader 34 and a container presence/absence detection sensor 36 are arranged so as to hang downward at the tip portion thereof. The label reader 34 and the container presence/absence detection sensor 36 are arranged to face the side surface of the source sample rack 22 which is opposite to the side surface of the source sample rack 22 facing to the first guide rail 30. A bar code reader can be used for the label reader 34, for example, and a reflection-type optical sensor can be used for the container presence/absence sensor 36, for example.

[0024] In the structure described above, by controlling the detection unit conveying mechanism 28, the moving arm 32 can be moved in the X-axis direction so that the label reader 34 and the container presence/absence sensor 36 can be moved in the X-axis direction, namely, in the direction along which the containers are arranged in the source sample rack. In this way, the detection of the presence or absence of each container is sequentially carried out by the container presence/absence sensor 36, and the bar code of the label stuck on each container is also sequentially read out by the label reader 34. The read out data is transmitted to a control section not shown in the drawings.

FIG. 4



## SAMPLE PRETREATMENT SYSTEM

### BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention is related to a sample pretreatment system, and in particular to a sample pretreatment system provided with secondary sample racks.

[0003] 2. Description of the Prior Art

[0004] In a sample pretreatment system which is equipped with an automatic pipetting apparatus for subdividing (pipetting) a source sample such as a blood sample or the like into a plurality of secondary sample containers, there is provided a secondary sample rack in which a plurality of secondary sample containers are held in rows. When pipetting a source sample, a pipetting nozzle is moved to a source sample container containing a source sample to be pipetted and then aspirates the source sample for a predetermined amount. Thereafter, the pipetting nozzle is moved to a secondary sample rack with keeping the aspirated source sample therein, and then dispenses a predetermined amount of the sample to secondary sample containers. When the pipetting operation is completed for all the predetermined secondary sample containers, the secondary sample rack is taken out and fed to the next stage for examination or analysis or the like.

[0005] However, in the conventional system described above, when a source sample has to be pipetted urgently, there arises a problem upon taking out and feeding the secondary sample rack to the next stage. Specifically, when an urgent source sample has to be pipetted during normal pipetting operations, an urgent source sample rack is placed in the system manually, and pipetting of the sample is carried out preferentially. However, in this preferential pipetting operation, the sample is pipetted to secondary sample containers held in the secondary sample rack in the same manner as the normal pipetting operation. The secondary sample rack is taken out after the pipetting of the sample for all the secondary sample containers held in the rack have been completed as described above. Therefore, even though the pipetting operation of the urgent source sample is preferentially carried out, it is not possible to feed the secondary sample rack to the next stage for examination until the pipetting of the sample for all the predetermined secondary sample containers has been completed, thus loss of time can not be avoided.

[0006] In order to avoid such loss of time, in a practical site only secondary sample containers to which the urgent sample has been pipetted are selected from the secondary sample rack to pick up them manually. However, this needs to locate the secondary sample containers to which the urgent source sample has been pipetted from among all the secondary sample containers held in the secondary sample rack, and thus this operation is quite troublesome for a user. As described above, in the conventional system, it is troublesome to feed the secondary sample containers containing the urgent source sample into the next stage.

### SUMMARY OF THE INVENTION

[0007] In view of the above problem in the conventional system, it is an object of the present invention to provide a sample pretreatment system which does not necessitate to

locate secondary sample containers to which an urgent source sample has been pipetted.

[0008] It is another object of the present invention to provide a sample pretreatment system capable of feeding secondary sample containers to which an urgent source sample has been pipetted into the next stage immediately.

[0009] In order to achieve the above objects, the present invention is directed to a sample pretreatment system. The sample pretreatment system comprises: a pipetting nozzle for pipetting a sample from a source sample container to secondary sample containers; a nozzle conveying apparatus for conveying the pipetting nozzle; a normal area in which at least one normal secondary sample rack which holds a plurality of normal secondary sample containers is placed; an urgent area in which at least one urgent secondary sample rack which holds a plurality of urgent secondary sample containers is placed; and control means for controlling the pipetting nozzle and the nozzle conveying apparatus, the control means controls the pipetting nozzle and the nozzle conveying apparatus so that in a normal pipetting mode a sample from the source sample container is pipetted to the secondary sample containers, and in an urgent pipetting mode a sample from the source sample container is pipetted to the urgent secondary sample containers.

[0010] According to the above structure, in the normal pipetting mode, a source sample is pipetted to normal secondary sample containers in the normal area as is the same with the conventional system, and in the urgent pipetting mode, a source sample is pipetted to urgent secondary sample containers in the urgent area which is separately arranged from the normal area. Therefore, since the urgent secondary sample containers are positioned in the urgent area, it is possible to locate them easily without looking for and selecting them as was done in the conventional system. As a result, it is possible to feed such urgent secondary sample containers to the next stage immediately. In this connection, the urgent secondary sample rack may be formed into a portable type or it may be fixedly mounted to a pipetting table.

[0011] Preferably, the sample pretreatment system may further include a pipetting table on which the normal area and the urgent area are provided, the pipetting table having a front side and the a back side, in which the normal area is arranged on the front side of the pipetting table and the urgent area is arranged on the back side of the pipetting table. Here, the front side of the pipetting table means the side of the table where an operator stands, and the back side means the opposite side of the front side. Normally, the pipetting table has a relatively large free space at the back side thereof. Therefore, according to this arrangement, it is possible to provide the urgent area on the back side of the pipetting table by utilizing such a relatively large free space effectively with the normal area for the normal secondary sample racks which are frequently replaced with other one being provided on the front side of the pipetting table. Further, without enlarging the width of the pipetting table, it is possible to provide such urgent area.

[0012] Further, preferably, the urgent secondary sample rack is formed into a portable type, and has a size smaller than the normal secondary sample container. Since the urgent secondary sample rack is not so frequently used, it is not required to have a large size. Further, it is better for the



European Patent  
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## EUROPEAN SEARCH REPORT

Application Number

EP 93 10 4301

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A-0 376 109 (BOEHRINGER MANNHEIM GMBH) * column 3, line 46 - line 57 * * column 5, line 56 - column 6, line 16; figure 4 * ---	1-3	G01N35/00 G01N35/00
A	EP-A-0 383 322 (FUJI) * column 6, line 24 - line 56 * * column 8, line 15 - line 32 * * column 8, line 47 - line 58 * * column 10, line 25 - line 28 * * column 21, line 46 - column 22, line 16; figure 1 * ---	1-3	
X,D	EP-A-0 353 589 (ABBOTT) * page 20, line 33 - line 39 * * page 21, line 18 - line 19 * * page 21, line 39 - line 42 * -----	3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			G01N
<p>The present search report has been drawn up for all claims</p>			
Place of search <b>THE HAGUE</b>	Date of completion of the search <b>09 JULY 1993</b>	Examiner <b>HOCQUET A.P.</b>	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

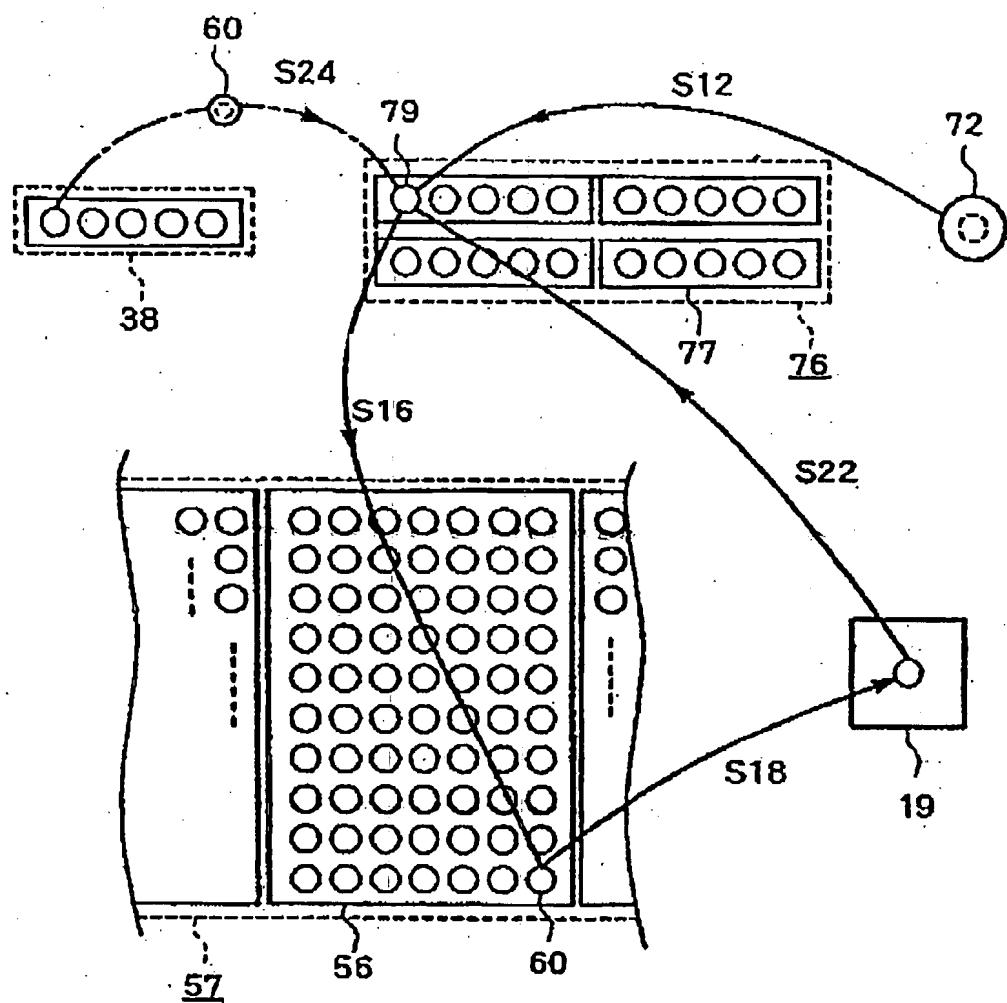


Fig. 3